IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Kevin David Potter
Application No.:	10/532,438
Filing Date:	December 28, 2005
Examiner:	Nathan J. Bloom
Art Unit:	2624
Confirmation No.:	9117
For:	POSITIONAL MEASUREMENT OF A FEATURE WITHIN AN IMAGE

VIA EFS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

AMENDMENT AFTER FINAL OFFICE ACTION
(submission under 37 C.F.R. 1.116)

Dear Sir:

Applicant submits this Amendment after an Office Action made final and mailed on February 19, 2009, and in view of an interview held with the Examiner on May 7, 2009, followed by an Interview Summary mailed May 11, 2009. This paper cancels claims, presents claims for consideration before appeal and is considered to be in compliance with 37 C.F.R. § 1.116. Applicant respectfully requests entry of this paper, consideration of the remarks provided herewith, and allowance of the claims pending. No new matter has been introduced and no new issues requiring further search have been introduced. Applicant also points to and respectfully requests entry of a Substitute Specification filed with and on the same day as the original application for patent on April 22, 2005.

REAL PARTY IN INTEREST

The real party in interest in the above-identified patent application is The University of Bristol. The present application was assigned to The University of Bristol, by an assignment

1

from the inventors recorded on December 22, 2005, in the Assignment Records of the United States Patent and Trademark Office at Reel 016931, Frame 0747.

RELATED APPEALS AND INTERFERENCES

There are no related appeals, interferences or judicial proceedings known to Applicant or Applicant's representatives which may be related to, will directly affect, or be directly affected by or have a bearing on the Board's decision on the pending appeal.

STATUS OF CLAIMS

Claims 61-64, 66-67, 69-72, 77 and 90-99 are pending in the present application. Claims 61-64, 66-67, 69-72, 77 and 90-99 have been rejected pursuant to an office action made final and mailed February 19, 2009 (hereinafter, "the Final Office Action"). Claims 65 and 73-76 have been canceled with this paper without prejudice. The rejection of Claims 61-64, 66-67, 69-72, 77 and 90-99 is to be reconsidered and removed.

STATUS OF AMENDMENTS

No amendment has been filed subsequent to mailing of the Final Office Action.

SUMMARY OF CLAIMED SUBJECT MATTER

Independent Claim 61 is directed to a method for determining coordinates of a feature comprising providing a first image including the feature, the first image comprising a plurality of pixels, determining a first estimate of coordinates of the feature to within a fraction of a pixel, translating the feature relative to the pixels by a pixel translation value, wherein the sum of the pixel fraction and pixel translation value is an integer value, determining a second estimate of coordinates of the translated feature to within a fraction of a pixel and summing the pixel fractions of the first estimate with the second estimate to derive a refined estimate of coordinates. [Described at least at pg. 3, second and third paragraphs; pg. 4, fifth and seventh paragraphs; pg. 5, last paragraph; pg. 10, second and third paragraphs; pg. 11, second through fifth paragraphs; pg. 12; pg. 14 of the original specification filed as WO 2004/038328.]

Independent Claim 69 is directed to an apparatus for determining a position of an object comprising an image capture device arranged to provide a captured image encompassing the object, the captured image comprising a plurality of pixels, and an image processor arranged to receive the captured image and determine the position of the object by executing the method of claim 61. [Described at least at pg. 3, second and third paragraphs; pg. 4, fifth and seventh paragraphs; pg. 5, last paragraph; pg. 10, second and third paragraphs; pg. 11, second through fifth paragraphs; pg. 12; pg. 13; pg. 14, pg. 15, last two paragraphs of the original specification filed as WO 2004/038328.]

Independent Claim 71 is directed to an apparatus for determining a position of an object comprising an image capture device arranged to sequentially provide a plurality of captured images of an object, each captured image having a plurality of pixels, an image processor arranged to sequentially receive the plurality of captured images and determine the position of the object from the plurality of captured images by executing the method of claim 61, and a position comparator arranged to compare the determined position of the object for the plurality of captured images and identify whether the determined position changes in the plurality of captured images. [Described at least at pg. 3, second and third paragraphs; pg. 4, fifth and seventh paragraphs; pg. 5, last paragraph; pg. 9, fifth and sixth paragraphs; pg. 10, second and third paragraphs; pg. 11, second through fifth paragraphs; pg. 12; pg. 13; pg. 14, pg. 15, last two paragraphs; pg. 17, second, third and fourth paragraphs; pg. 18 of the original specification filed as WO 2004/038328.]

Independent Claim 77 is directed to a method for determining coordinates of a feature comprising providing at least one image including the feature, the at least one image comprising a plurality of pixels, correlating the feature and the at least one image using a predetermined correlation function to determine coordinates of the feature to the nearest pixel, evaluating the correlation function at a plurality of sub-pixel positions in the neighborhood of the determined coordinates to provide a plurality of values and fitting the plurality of values to a further function, and differentiating the further function to determine its maximum, whereby coordinates corresponding to the maximum are coordinates of the feature to within a fraction of a pixel. [Described at least at pg. 3, second and third paragraphs; pg. 4, fifth and seventh

3

paragraphs; pg. 5, last paragraph; pg. 10,first, second and third paragraphs; pg. 11, second through fifth paragraphs; pg. 12; pg. 13; pg. 14, pg. 15, last two paragraphs of the original specification filed as WO 2004/038328.]

Independent Claim 90 is directed to method for determining coordinates of an object, the method comprising the steps of capturing at least one first image and at least one second image of the object, each image being captured having different coordinates with respect to the other, determining the position of the object within each image, wherein determining includes, providing the first image including a feature, the first image comprising a plurality of pixels, determining a first estimate of coordinates of the feature to within a fraction of a pixel, translating the feature relative to the pixels by a pixel translation value, wherein the sum of the pixel fraction and pixel translation value is an integer value, determining a second estimate of coordinates of the translated feature to within a fraction of a pixel, summing the pixel fractions of the first estimate with the second estimate to derive a refined estimate of coordinates; and comparing the determined positions of the object to determine dimensional changes. [Described at least at pg. 3, second and third paragraphs; pg. 4, fifth and seventh paragraphs; pg. 5, last paragraph; pg. 9, last two paragraphs; pg. 10,first, second and third paragraphs; pg. 11, second through fifth paragraphs; pg. 12; pg. 13; pg. 14, pg. 15, last two paragraphs of the original specification filed as WO 2004/038328.]

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Whether the Examiner erred in rejecting Claims 61-64, 66-67, 69-72, 77 and 90-99 under 35 U.S.C. § 103(a), as being obvious over U.S. Patent No. 5,280,530 (hereinafter "Trew") in view of U.S. Patent No. 6,483,538 (hereinafter "Hu").

ARGUMENT

The rejection of Claims 61-64, 66-67, 69-72, 77 and 90-99 under 35 U.S.C. § 103(a), as being obvious over Trew in view of Hu is unreasonable and incorrect.

A. The existing claim language does not *only* require that the feature be moved relative to the pixels.

4

In the Interview Summary mailed May 11, 2009, it was written, "Examiner explained that the currently existing claim language only required that the feature be moved relative to the pixels." Applicant respectfully disagrees with such a statement and respectfully point out that the existing claim language does not *only* require that a feature be moved relative to the pixels. Applicant respectfully points out that the claim language is more encompassing than this unreasonable and narrow interpretation. For example, Claim 61, one of the independent claims, used by way of example, discloses, among many things: (a) a feature is translated relative to the pixels; (b) by a pixel translation value and (c) wherein the sum of the pixel fraction and the pixel translation value is an integer value. A copy of Claim 61 is shown below as last written in the Amendment dated November 10, 2009, and used to illustrate Applicant's statement.

Claim 61.   *(Currently Amended)* *A method for determining coordinates of a feature comprising:*

    providing a first image including the feature, the first image comprising a plurality of pixels;

    determining a first estimate of coordinates of the feature to within a fraction of a pixel;

    translating the feature <u>relative to the pixels</u> by a pixel translation value, wherein the sum of the pixel fraction and pixel translation value is an integer value;

    determining a second estimate of coordinates of the translated feature to within a fraction of a pixel; and

    summing the pixel fractions of the first estimate with the second estimate to derive a refined estimate of coordinates.

        B.   A claimed element "translating the feature relative to the pixels" is not described by Trew in view of Hu.

The Examiner stated in the interview held on May 7, 2009, and in the Final Office Action that "translating the feature relative to the pixels" was taught by the cited documents because a test image as disclosed by Hu contains a feature also present in the reference image

and when the test image is generated, the location of the feature in the test image is different from that of the location of the feature in the reference image and consequently the feature was said to be "shifted." This statement by the Examiner shows that the Examiner is relying on two distinct aspects of Hu to show a single combination of claimed features, namely "translating the feature relative to the pixels by a pixel translation value." Applicant further outlines their reasoning below that the statement made by the Examiner is unreasonable and incorrect.

By way of background, Trew discloses tracking a moving object in a scene, over a series of two dimensional picture frames. Each two dimensional picture frame will have pixels and the object will be at a different position in each frame due to movement of the object. The object of Trew may appear different between frames due to its position relative to the pixels. This very problem is what is addressed (e.g., modeled) by the Applicant's claimed invention. Trew does <u>not</u> teach shifting the object for any reason (the object moves of its own accord).

Regarding Hu, the reference discloses a system for aligning a test image with a reference image. An <u>image</u> has a plurality of pixels (column 3, lines 3 to 4). The feature in the test image of Hu is aligned with the feature in the reference image by overlaying a "test block" on each image. The test block may move relative to an image. Thus the test block moves relative to both the pixels of an image and the feature within an image, <u>as opposed to moving the feature relative to the pixels of the image.</u> This is an important distinction. In Hu, the position of the feature in the test image, relative to the pixels of the test image, *will not change* by shifting the test block. Instead, the test block will 'choose' different areas of pixels upon which the FFT will be performed. <u>Therefore shifting the test block will not have an effect on the appearance of the feature within the test image</u>

Thus, neither Trew nor Hu disclose "*translating the feature relative to the pixels by a pixel translation value.*" Moreover, this feature cannot be derived from Trew in view of Hu. Even if the "test block" of Hu was applied to the teaching of Trew it would not result in the object of Trew appearing any different (thus the aliasing effect would <u>not</u> be modeled) because the test block does <u>not</u> cause the object/feature to move <u>relative to the pixels</u>.

6

To better illustrate the points made above, Applicant has broken up Claim 61 into several elements in order to assist in showing why said statement made by the Examiner is unreasonable and incorrect.

Claim 61, lines 1-4:

> *61. (Currently Amended) A method for determining coordinates of a feature comprising:*
>
>> *providing a first image including the feature, the first image comprising a plurality of pixels;*

The Examiner stated in the Final Office Action that Trew describes the features above at Column 2, lines 20 -37; Column 3, lines 65+; and Column 4, lines 20-65. This means that the Examiner is specifically referring to the use of an initial template image that includes the desired feature.

Claim 61, line 5:

>> *determining a first estimate of coordinates of the feature . . .*

The Examiner stated in the Final Office Action that Trew describes the above feature by relying on the same passages as described with the previous section, namely, Column 2, lines 20 -37; Column 3, lines 65+; and Column 4, lines 20-65. The Examiner's reason was due to the "determination of the coordinates of a feature in a series of images

Claim 61, lines 5-6:

>> *. . . to within a fraction of a pixel;*

The Examiner stated in the Final Office Action that Hu teaches the above feature. It is noted that Hu specifically teaches a curve-fit step (46), which is described in a text box for Figure 3 as "quad curve-fit for fractional pixel position about peak location." The nearest

7

integer shift position determined at curve-fit step (46) is input to an update shift position step (48) (see Column 3, lines 18, 19). This is relevant for the reasons set forth below.

Claim 61, line 7:

> *translating the feature relative to the pixels . . .*

The Examiner stated in the Final Office Action (pg. 4), "the feature described by Trew in view of Hu is described by pixels, and is shifted in relation to pixels." In the telephone interview held with Applicant's representatives on May 7, 2009, the Examiner further stated that the above feature (i.e., *translating the feature relative to the pixels*) was taught by Hu because its test image (26) contains a feature (25) that is also present in reference image (24) and when test image (26) is generated, by passing a reference video signal (10) through a video processing network (12), the location of feature (25) in test image (26) is "shifted" relative to feature (25) in reference image (24). Another way of describing this is that when test image (26) is generated, the position of feature (25) is different to the position of feature (25) in reference image (24), thus feature (25) has "shifted." Hu demonstrates this in Figure 2.

Claim 61, lines 7-8:

> *. . . by a pixel translation value, wherein*
> *the sum of the pixel fraction and pixel translation value is an integer value;*

The Examiner stated in the Final Office Action that Hu, at Column 3, lines 5-20, implicitly discloses the above features. Applicant found that the passage specifically describes performing a fast Fourier transform (FFT) to the pixels of the images that lie within test region (28) of each image. In the FFT domain, a cross-correlation is then performed by Hu to establish peak (44), which is the amount of shift in position between the reference image (24) and test image (26). In the Final Office Action (pg. 4), the Examiner emphasized how Hu teaches the shift of the measured pixel position to the nearest integer pixel position. Unfortunately, such statements show that the Examiner is relying on two distinct and differing aspects of Hu to reject a single combination of features of the claimed invention. For

8

example, the "nearest integer pixel shift" of Hu as determined at curve-fit step (46) is a value that governs <u>how</u> far test region (28) provided over test image (26) is to be shifted relative to test image (26) and is designed to increase the cross-correlation previously described above. Thus, the Examiner is relying on both a relationship between reference image (24) and test image (26) to teach the feature of *translating the feature relative to the pixels* as well as a relationship based on moving test region (28) provided over test image (26) relative to test image (26) to show the feature of *by a pixel translation value*. Applicant respectfully points out that this is taking the language and disclosure of Hu out of context, such that dissimilar features of Hu are forced together in order to arrive at a reason for rejecting the claim. Applicant respectfully points to statements previously made by Applicant in both a Supplemental Amendment dated December 9, 2008 and to a fax dated April 15, 2009, entitled "Outline of Topics for Discussion" that accompanied an Applicant Initiated Interview Request Form. In both previously submitted documents, Applicant provided a statement of fact that shifting test region (28) provided over test image (26) relative to test image (26) as disclosed by Hu does <u>not</u> translate feature (25) within test image (26) relative to the pixels thereof. Consequently, it is not correct for the Examiner to try to combine two dissimilar elements of Hu to arrive at an incorrect statement that Hu teaches *translating the feature relative to the pixels by a pixel translation value.*

Even if the Examiner considers that a final step described by Hu of aligning its two images (e.g., reference image and test image) are the same as the feature of Claim 61, line 7 (i.e., *translating the feature relative to the pixels by a pixel translation value*), Hu does not suggest or describe *translating the feature relative to the pixel by the specific pixel translation value or by a pixel translation value, wherein the sum of the pixel fraction and pixel translation value is an integer value,* which are instrumental for performing Applicant's claimed invention (e.g., how aliasing effects on a feature are modeled).

C. Claimed elements "*determining a second estimate of coordinates of the translated feature to within a fraction of a pixel*" and "*summing the pixel fractions of the first estimate with the second estimate to derive a refined estimate of coordinates*" are not described by Hu.

9

Setting aside for one moment the fact that Hu fails to teach features of Claim 61 at lines 1-8, Hu also specifically fails to describe other recited features (e.g., Claim 61, lines 9-12, as shown below).

Claim 61, lines 9-12

> *determining a second estimate of coordinates of the translated feature to within a fraction of a pixel; and*
>
> *summing the pixel fractions of the first estimate with the second estimate to derive a refined estimate of coordinates.*

The Examiner stated in the Final Office Action that Hu describes the above features at Column 3, lines 21-44. However, after a review of Column 3, lines 21-44, it is clear that Hu is specifically teaching performing a cross correlation using an original FFT [referred to by Hu as FFT(ref)] and a newly established FFT [referred to by Hu as FFT(tst)] in order to refine and update the final position. Thus, Hu does not use a second determination or estimate as to the coordinates of a feature which has been translated relative to the pixels of an image. And, as such, Hu is incapable of having a second determination benefit from a change in appearance of the feature.

In view of the above and contrary to statements made by the Examiner in the Final Office Action, Applicant respectfully reiterates that the pending claims are both novel and non-obvious over Trew in view of Hu because neither Trew nor Hu may be combined by their own teachings or by what is known to a person of skill in the art in order to arrive at a method or apparatus as claimed by Applicant, including a method whereby a feature is translated by the specified pixel translation value prior to a second determination of the coordinates of the feature being made.

CONCLUSION

In view of the errors noted above with regard to the Examiner's rejection of claims 61-64, 66-67, 69-72, 77 and 90-99, Applicant earnestly seeks a Notice of Allowance for Claims 61-64, 66-67, 69-72, 77 and 90-99 as provided in the Claims Appendix at the end of this paper.

Dated: June 19, 2009

GARDERE WYNNE SEWELL LLP

By: *Monique A. Vander Molen*
     Monique A. Vander Molen
     Registration No.: 53,716

Address for Correspondence:
Customer No. 32914